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# RIO Country Report 2016: Germany

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Innovation Observatory  
country reports series*

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**Research and Innovation Observatory Country Report 2016 Germany**

The 2016 series of the RIO Country Report analyses and assesses the development and performance of the national research and innovation system of the EU-28 Member States and related policies. It aims at monitoring and evaluating the EU policy implementation as well as facilitating policy learning in the Member States.

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## **Foreword**

This report offers an analysis of the R&I system in Germany for 2016, including relevant policies and funding, with a particular focus on topics of critical importance for EU policies. The report identifies the main challenges of the German research and innovation system and assesses the policy responses implemented. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports and online publications. The quantitative data are, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in January 2017. The report contents are partly based on the RIO Country Report 2015 (Sofka, Sprutacz, 2016).

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## HIGHLIGHTS

- German GDP grew by 1.7% in 2015 with forecasts projecting growth rates at roughly the same level for 2016 and 2017.
- Both government and businesses have increased their investments in R&D in 2015 and reached the 3% goal of R&D as share of GDP.
- On the government side, the collaboration between Federal and Länder governments for R&I bears further fruits (a.o. agreement on Excellence Strategy).
- Business R&D investment relies on large firms with the automotive industry as the most important contributor. R&D expenditures by SMEs have increased in 2015 after weaker contributions in previous years.

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## MAIN R&I POLICY CHALLENGES

- **Reinvigorate innovation in SMEs.** The contribution of SMEs to overall business R&D expenditures has been declining for years with more positive numbers in 2015. SMEs spent about 10% more on R&D in 2015 than the year before. Most of the obstacles to innovation for SMEs stem from shortages of financial and human resources. Public attention and resources are focussed on the issue. It remains open whether current policies reach small SMEs and those with occasional R&D needs, i.e. the major contributors to the declining trend.
- **Capitalise on business opportunities from the digital economy.** Germany is positioned in the middle field of countries benefitting from business opportunities in the digital economy. A large number of start-ups are coming up with innovative digital business models. Business model creation and innovation play a role in public support but many existing measures are set up for supporting technological innovation.

There are many but also fragmented support schemes. Increased coordination, priority setting and resource allocation can unlock potentials in the follow up of the Digital Agenda 2014-2017.
- **Encourage entrepreneurship.** The two innovation challenges above are both connected to shortcomings in entrepreneurship performance. Trends for entrepreneurship in Germany are negative in general as well as for the knowledge-intensive sectors in particular. The challenge originates from a mix of reasons including underdeveloped small venture capital markets, tax and regulatory obstacles, a lack of exit prospects for venture capital providers as well as demographics and a healthy labour market. Policy makers have demonstrated sensitivity to recent evaluation reports and improved procedures as well as framework conditions. The absence of a stock market segment for Initial Public Offerings (IPOs) for venture capital remains a disadvantage which is largely outside of the control of government.

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## MAIN R&I POLICY DEVELOPMENTS IN 2016

- Federal and Länder agreement for an [Excellence Strategy](#) ('Exzellenzstrategie')
- Federal and Länder agreement on the funding measure "Innovative Higher Education Institutions" ('Innovative Hochschule') - joint funding initiative promoting research-based ideas, knowledge and technology transfer and the collaboration between institutes of higher education with business and society
- Ten Point Programme "[Priority to SMEs](#)" ('Vorfahrt für den Mittelstand')
- [Framework programme for research on greater internet security](#) ('Selbstbestimmt und sicher in der digitalen Welt 2015-2020')
- [Framework programme for research and innovation 2016-2020 for microelectronics](#) ('Mikroelektronik aus Deutschland - Innovationstreiber der Digitalisierung')

# 1. Main R&I policy developments in 2016

<p><b><u>Excellence Strategy</u></b>  <b>(‘Exzellenzstrategie’)</b>  (06/2016)</p>	<p>Federal and Länder governments reached an agreement for an Excellence Strategy to replace the current Excellence Initiative as from 2017. The initiative is endowed with €533m annually and financed by the Federal government (75%) together with the Länder (25%). Contrary to its predecessor, this new agreement is not limited in time. Following the change of the constitution in 2014 the Federal Government can now under certain circumstances fund R&amp;I in higher education permanently.</p>
<p><b><u>“Innovative Higher Education Institutions”</u></b>  <b>(‘Innovative Hochschule’)</b> (06/2016)</p>	<p>Federal and Länder governments reached an agreement for a new joint funding initiative promoting research-based ideas, knowledge and technology transfer and the collaboration between institutions of higher education with business and society called “Innovative Higher Education Institutions” (‘Innovative Hochschule’) with a budget of €550m between 2018 and 2027 (GWK, 2016b).</p>
<p><b><u>Priority to SMEs</u></b>  <b>(‘Vorfahrt für den Mittelstand’)</b> (01/2016)</p>	<p>The new Ten Point Programme for the Federal Ministry of Education and Research (BMBF) announces an increase of 30% in funding available to SMEs, reaching €320m in 2017. It addresses many of the shortcomings in public support to innovative SMEs identified by the Expert Commission on Research and Innovation in its report for 2016 (EFI, 2016). Recent data shows a significant increase in R&amp;D expenditures by SMEs. In 2015, SMEs with less than 250 employees spent 16% more on internal research projects than in 2014. The call of the Expert Commission on Research and Innovation (EFI) for R&amp;D tax credits remains unaddressed.</p>
<p><b><u>Framework programme for research on greater internet security</u></b>  <b>(‘Selbstbestimmt und sicher in der digitalen Welt 2015-2020’)</b>  (01/2016)</p>	<p>Framework programme with €180m in funding until 2020</p>
<p><b><u>Framework programme for research and innovation 2016-2020 for microelectronics</u></b>  <b>(‘Mikroelektronik aus Deutschland - Innovationstreiber der Digitalisierung’)</b>  (02/2016)</p>	<p>Framework programme with funding of up to €400m until 2020</p>

## 1.1 Focus on National and Regional Smart Specialisation Strategies

Description and timing: Smart specialisation is part of the Partnership Agreement between Germany and the European Commission on the implementation of the European

Structural and Investment Funds and at least implicitly part of Germany's new 'High Tech Strategy 2020' and explicitly part of the National Reform Programme. There is currently no policy document which explicitly outlines a smart specialisation strategy at federal level. Each Land went through the process of developing its own smart specialisation strategy.

Smart specialisation strategies have been adopted earlier in some Länder, e.g. in Saxony. The requirements of the European Regional Development Fund (ERDF) have led in all Länder to an active discussion of regional strategies and priorities. Most of the resulting strategies harness existing regional strengths instead of replacing them. By their design, the smart specialisation strategies of the Länder differ but each of them discusses complementarities in funding and effects with other instruments at federal and/or European level<sup>1</sup>. The ERDF operational programmes have detailed financial considerations for the implementation of the smart specialisation strategies. Most Länder have published their strategies as part of their ERDF operational programmes. Monitoring and evaluation are important parts of the strategies: relevant input indicators are correlated with evidence-based outcomes in pre-defined monitoring periods.

New developments: At federal level, Germany launched several policy initiatives to leverage geographical clusters such as the Leading-Edge Cluster Competition ('Spitzencluster-Wettbewerb') of the Federal Ministry for Education and Research. The federal government puts a priority on the internationalisation of the Leading-Edge Clusters. This is demonstrated by the successful application for two Knowledge and Innovation Communities ("Raw materials" and "Healthy living and active aging") in a European-wide competition of the European Institute of Technology which will be coordinated in Germany. The Federal Ministry for Education and Research supports the internationalisation of the 'Leading-Edge Clusters, future projects and comparable networks' ('Internationalisierung von Spitzenclustern, Zukunftsprojekten und vergleichbaren Netzwerken') with annual funding rounds between 2015 and 2017<sup>2</sup>.

Outstanding issues: All German ERDF and ESF operational programmes have been approved for the period 2014-2020.

## **2. Economic Context**

Real GDP expanded by 1.7% in 2015, which is slightly below the EU-28 average growth rate of 2.2%. According to the Autumn 2016 Economic Forecast of the European Commission real GDP is expected to increase by 1.9% in 2016 (EU-28: 1.7%), 1.5% in 2017 (EU-28: 1.5%) and 1.7% in 2018 (EU-28: 1.7%). The unemployment rate stood at 4.6% in 2015 which is roughly half of the average of EU-28 (9.4%). Gross debt is set to remain on a downward trend (budget surpluses of 0.3% of GDP in 2014 and 0.7% in 2015). Risks to the economic development include, among other things, uncertainty surrounding the strong inflow of asylum seekers.<sup>3</sup>

### **2.1 Structure of the economy**

Manufacturing accounted for 22.8% of value added in Germany in 2015 and 17.5% of employment (EU-28: 15.5% and 14% respectively in 2014). The share of service sectors

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<sup>1</sup> BMWi provides an overview on EFRE and ESF conditions as well as project examples. <http://www.bmwi.de/DE/Themen/Europa/Strukturfonds/bund-laender.html> Otherwise there is no information platform available that would allow the comparison or progress tracking of Länder regionalisation strategies.

<sup>2</sup> [https://www.bmbf.de/de/cluster-netzwerke-international-547.html?pk\\_campaign=20-06-2016-+Newsletter+-+BMBF+-+Pressemitteilungen&pk\\_kwd=https%3A%2F%2Fwww.bmbf.de%2Fde%2Fcluster-netzwerke-international-547.html](https://www.bmbf.de/de/cluster-netzwerke-international-547.html?pk_campaign=20-06-2016-+Newsletter+-+BMBF+-+Pressemitteilungen&pk_kwd=https%3A%2F%2Fwww.bmbf.de%2Fde%2Fcluster-netzwerke-international-547.html) (8/2016)

<sup>3</sup> European Commission Autumn 2016 Economic Forecast  
[http://ec.europa.eu/economy\\_finance/eu/forecasts/2016\\_autumn\\_forecast\\_en.htm](http://ec.europa.eu/economy_finance/eu/forecasts/2016_autumn_forecast_en.htm)



on total value added in Germany has remained stable at 68.0% in 2015. The share of knowledge-intensives services on total value added, though, has slightly declined to 34.5% in 2015 (36.3% in 2013). The accumulated share of exports and imports amounts to 86% of German GDP which is the highest degree of trade openness of any G7 country in 2015 (BMW, 2016). Germany continued to show a comparative advantage in trade in R&D-intensive goods in 2014. However, a closer look reveals that this is true only for trade in high-value technology goods and does not hold for trade in cutting-edge technology goods (EFI, 2016).

Labour productivity in Germany (GDP per capita) has increased by 4.2% since 2010 which is very much in line with EU-28 average of 4.5%. Average annual growth rates in labour productivity (GDP per hour worked) amount to 1.2% between 2009 and 2014 as well as 1.3% between 1995 and 2014. For comparison Sweden had increases of 1.1% and 1.7% respectively, Denmark 1% and 0.9%. Capital productivity in Germany had an annual growth rate of 1.1% between 2009 and 2014, in a period in which most other countries investigated had slower or negative change rates, e.g. Sweden 0.3% or Denmark -0.3%. Multifactor productivity, i.e. the component closest related to technological change as the residual change in output which is not explained by changes in labour or capital, increased by 1.2% in Germany between 2009 and 2014 and 0.8% between 1995 and 2014. For comparison Sweden had increases of 0.8% and 0.9% respectively, Denmark 0.6% and 0.1% (OECD, 2016a).

## **2.2 Business environment**

The framework conditions for business R&I in Germany facilitate R&D activities of companies and have supported a continuous, multi-year expansion of business R&D investment as well as an increase in non-R&D innovation expenditures (European Commission, 2015). This positive picture is clouded somewhat by a largely unchanged innovation intensity in SMEs, which increased slightly in 2015 by 0.1 percentage points (ZEW, 2017) (see chapter 5.1 'Reinvigorate innovation in SMEs'). In the World Bank's latest "Doing Business" report which provides comparable data across countries for regulations which enhance or constrain business activity, Germany ranks 17th out 190 countries (World Bank, 2016). The report puts Germany within the range of the other EU innovation leader countries Sweden (9th rank), Finland (13th rank), the Netherlands (28th rank) and Denmark (3rd rank). The largest deficits emerge in the areas of starting a business (114th rank), registering property (79th rank) and paying taxes (48th rank); shortcomings which have also been linked to several of the innovation challenges discussed in chapter 5.

## **2.3 Supply of human resources**

Germany still has a strong human resources base underlying its R&I system. New doctorate graduates as share of population are more than double the EU average and the share of researchers in the total population is clearly above EU average as well. However, there are too few graduates from STEM subjects and, in the medium term, demographic change is projected to have an increasingly detrimental effect on the German economy's potential to innovate. A study by Aksoy et al. (2015) estimates a decline in annual per capita GDP growth of 0.6 percentage points between the last decade and the present decade as a result of demographic change (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung, 2015).

## **3. Main R&I actors**

R&I is a shared responsibility of the Federal Government and the 16 Länder. At the national level, the Federal Ministry of Education and Research (BMBF) covers most of the responsibilities for research policy. The Federal Ministry of Economics and Energy (BMWi) is involved in some areas of innovation and technology policy. The Länder fund the universities in their state. Since the revision of Article 91b of the German Basic Law on 1 January 2015, the Federal Government and the Länder can cooperate on a much broader scale in the funding of science, research and teaching. New initiatives are e.g. the

Excellence Strategy and the Tenure Track Programme. Much of publicly funded research is conducted in the university system and in the non-university public research organisations which are co-funded by the Federal government and the Länder. The four major non-university research organisations are Max Planck Society (MPG), Fraunhofer Society (FhG), Helmholtz Association (HGF), and Leibniz Association (WGL). They provide a dynamic element to the German R&I system because of their ability to respond to changing research opportunities and requirements through internally competitive funding allocation mechanisms. The German Research Foundation (DFG) complements institutional funding with project funding for basic research, selecting the most promising research projects by scientists and academics at universities and non-university research institutions based on a competitive basis.

In 2015, the German Higher Education landscape counted about 400 institutions, including 110 universities and more than 230 universities of applied sciences. R&D performed by German HEIs represents about 0.50% of GDP and is funded through a combination of institutional funding and project funding (e.g. Initiative of Excellence, R&D thematic programmes by BMBF) and contract research conducted for industry. R&D performed by academia and funded by the German private sector amounts to 0.07% of GDP. These shares are quite stable and have not changed much over the past years. The institutional funds received by universities are for both teaching and research and are largely provided by the Länder.

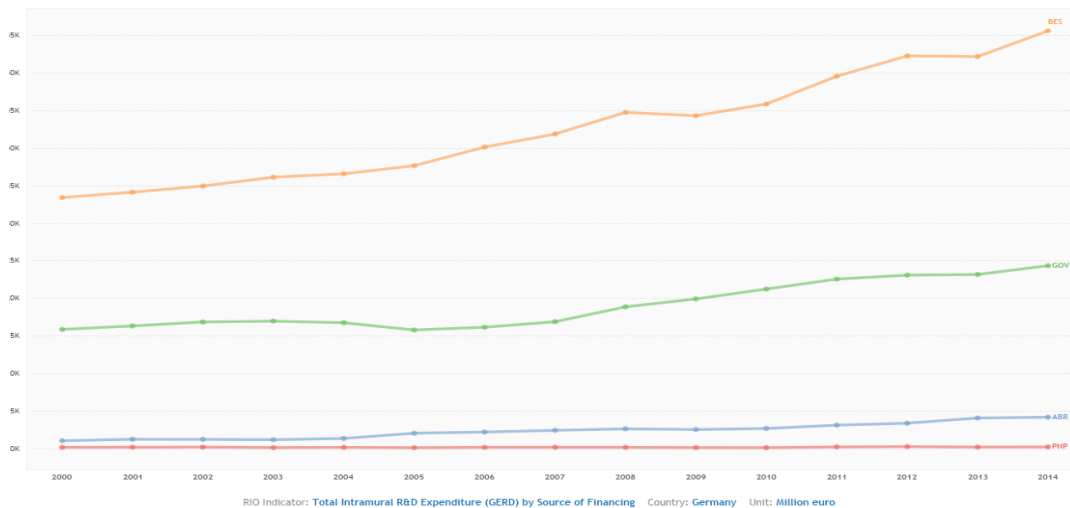
The car manufacturing industry clearly is the most important contributor to German business R&D, accounting for 35% of internal R&D (almost €22b in 2015 and up by 10% from 2014) expenditures in 2015 and 26% of R&D personnel (Stifterverband, 2016). Other industries within medium-high tech manufacturing, such as machinery, electric equipment, chemicals as well as pharmaceuticals, are also large R&D investors. In 2015, eight of the 50 largest R&D investors worldwide were headquartered in Germany. Then again, innovation intensity stayed constant and innovation performance of the particularly important SME sector in Germany decreased slightly over recent years (see chapter 5.1 "Reinvigorate innovation in SMEs").

There are several private foundations for financing research. Examples for such foundations include the Volkswagen Stiftung, Fritz Thyssen Foundation, Alexander von Humboldt Foundation (AvH) and the Bosch Foundation.

Germany has several policy initiatives to leverage geographical clusters such as the Leading-Edge Cluster Competition ('Spitzencluster-Wettbewerb') and the initiatives Entrepreneurial Regions ('Unternehmen Region') and 'Zwanzig20 – Partnerschaft für Innovation' of BMBF. Apart from these cluster initiatives, the German Federation of Industrial Research Associations (AiF) plays a crucial role in connecting research and innovation.

## **4. R&I trends**

According to provisional national statistics, gross R&D expenditures (GERD) in Germany have reached 2.99% of GDP in 2015 (Stifterverband, 2017). This is an increase compared to the previous Eurostat estimates (2.87%) mainly due to growing business expenditures on R&D (provisional national data, Stifterverband, 2017). Total R&D expenditures in Germany have significantly increased in nominal terms between 2012 and 2015 with a significant increase as a share of GDP in 2015 (provisional national statistics). This level is significantly above the average of EU-28 of 2.03% in 2015.



**Figure 1** Trend of GERD by sources of funding  
Data source: Eurostat, 2016

## 4.1 Public allocation of R&D and R&D expenditure

Government budget appropriations or outlays for research and development (GBAORD) amounted to €25.9b in 2015 which is about 5.5% higher than in 2012 and corresponds to about 0.85% of GDP (EU-28: 0.67%). In 2015, The Federal Government has spent €15b on R&D which is an increase by €0.8b compared to 2014 and significantly higher than 2010 (€12.8b) and 2012 (€13.4b) (BMBF, 2016b). R&D expenditures by the Federal Government are planned to increase to €15.8b in 2016 (BMBF, 2016b). R&D expenditures of the Länder are slightly lower (roughly 75% of the investments of the Federal Government) and also not developing as dynamically. They amounted to €10.1b in 2013 which is at the level of 2012 (€10.1b) but higher than 2010 (€9.7b).<sup>4</sup> Among the Länder Nordrhein-Westfalen had the highest share of total Länder R&D expenditures in 2013 with 20.4%, followed by Bayern (16.5%) and Baden-Württemberg (13.7%) (BMBF, 2016b). Over the decade from 2003 to 2013 R&D intensity increased in all Länder but in Berlin where it declined slightly from 3.65% to 3.57% (EFI, 2016).

Gross debt is set to remain on a downward trend which may leave some room for increased public investment without breaching EU and national debt rules. This fact has been pointed to repeatedly by the European Commission, encouraging Germany to step up its efforts in infrastructure, education, research and innovation funding for sustained national GDP growth and sustained recovery in the euro area (Council of the European Union, 2016; European Commission, 2016b).

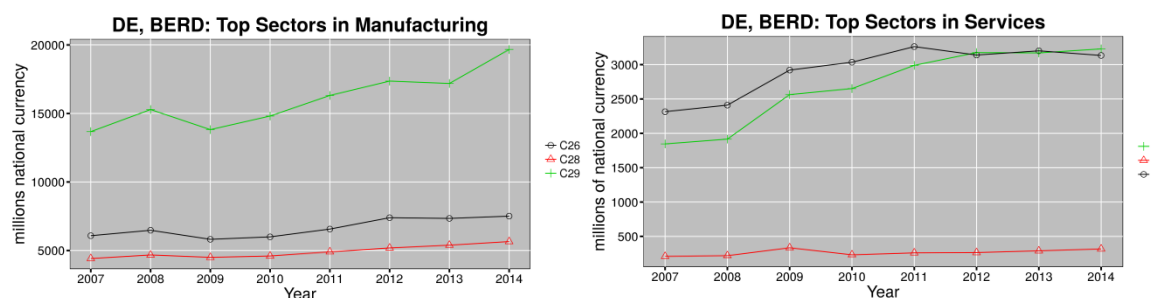
As a further option for boosting public support for research and innovation and as a means for reinvigorating the innovative strength of German SMEs, the Expert Commission on Research and Innovation (EFI) has in its 2016 report called again for the introduction of R&D tax incentives which it regards as an important complement to the funding instruments currently in use (EFI, 2016). However, the introduction of dedicated R&D tax credits is currently not part of the policy discussion in Germany.

## 4.2 Private R&D expenditure

Business expenditures on R&D (BERD) accounted for 2.06% of GDP (provisional national data, Stifterverband, 2017) in 2015 representing 69% of total R&D expenditures. This

<sup>4</sup> <http://www.datenportal.bmbf.de/portal/en/Table-1.2.4.html> (7/2016)

figure is up from 1.9% in 2013. A two-third contribution of the business sector to total R&D expenditures is also part of the quantitative goals of Germany expressed in its 2016 National Reform Programme. Manufacturing accounts for more than 80% of all R&D expenditure. Business R&D expenditures are significantly above the average levels of EU-28 (2015: 1.30%). Within manufacturing, medium high-tech manufacturing sectors are predominant. The following three sectors account for almost 60% of all business R&D expenditures in 2014: a) motor vehicles and parts; b) electrical equipment, computer, electronic and optical products and c) machinery and equipment (Eurostat, 2016).



**Figure 2** Top sectors in Manufacturing (C26= computer, electronic and optical products, C28= Manufacture of machinery and equipment and C29= Manufacture of motor vehicles, trailers and semi-trailers). Top service sectors (J=information and communication, K=Financial and insurance activities, M=professional, scientific and technical activities).

Data source: Eurostat, 2016

A closer look reveals that R&D expenditures are primarily driven by the automotive industry (€20bn in 2014 and up by 14.5% from 2013). Provisional national level data indicate that the contribution of service sectors to R&D has strongly increased in 2015: professional, scientific and technical activities increased from €3,1bn in 2014 to €5bn in 2015 (Stifterverband, 2017).

Another noteworthy trend, illustrated by e.g. recent data of Germany's Stifterverband (Stifterverband, 2015), consists in a shift from intramural R&D expenditures towards extramural expenditures which could be an indication for more open corporate innovation strategies characterised by increased usage of external knowledge and competence. Over the past 20 years intramural business R&D expenditures doubled while extramural expenditures quadrupled.

The share of foreign firms on business R&D expenditures in Germany has slightly declined from 25% to 23% in 2014. This is the first decline since record keeping started in the mid-1990s. The negative developments stems particularly from ICT and aerospace sectors. Nevertheless, Germany remains the second largest destination country for R&D of foreign firms behind the US.

Among young firms, the importance of research and innovation has increased in 2015. Roughly 95,000 or 12% of all entrepreneurs in 2015 were "innovative founders", i.e. they started a company which engages in R&D (KfW Research, 2016a). That reflects an increase of roughly 3,000 cases of innovative entrepreneurship compared with 2014, in a year in which overall entrepreneurship was down by 17% or 152,000 newly founded businesses.

The share of R&D financed by private, non-profit organisations is comparatively low at 0.01% of GDP in Germany in 2014 (EU-28 in 2014: 0.03%).

### 4.3 Public sector innovation and civil society engagement

Germany is generally well positioned for innovativeness and risk-taking in public innovation since a reliable legal framework is in place for many aspects of E-Government with the E-Government Act ('Gesetz zur Förderung der elektronischen Verwaltung', EGovG). Nevertheless, the actual use and provision at both at federal and Länder level of

e-government services is still rather limited compared to most other similarly developed countries. The Federal Government has also approved a working programme for improved legislation processes ('Bessere Rechtsetzung 2016') as part of its initiative for reducing bureaucracy ('Bürokratiebremse') in June 2016. The Federal Government has laid out goals for innovative public administration as a dedicated section in its Digital Agenda 2014-2017 (BMW, 2014). Many decisions on information technology or E-Government require coordination between Federal, Länder and municipality governments which are dealt with in the IT Planning Council ('IT-Planungsrat').

Innovation in the public sector is to an important degree enabled by the internet as well as the digitalization of information. A notable example in Germany includes the introduction of the electronic health card ('Elektronische Gesundheitskarte') (OECD, 2016b). However, the Digital Economy and Society Index (DESI) of the European Commission ranks Germany 18th of EU Member States in Digital Public Services in its 2016 report and significantly below its overall digital performance (9th rank) (European Commission, 2016a).

In its 2016 report, the EFI Commission analyses the United Nations E-Government Survey 2014 and concludes that Germany performs well in the initial stages of E-Government development, i.e. when information, links and documents are provided online (one directional), but has significant room for improvement in the digital interaction between citizens and government (two directional) and seamless transfer of information throughout a service process (EFI, 2016).

Increasing transparency and citizen participation is a general goal of the High Tech Strategy ('Hightech-Strategie 2020', BMBF, 2014) of the Federal Government and some progress has been made towards this target. BMBF has for example introduced in 2015 future forums ('ZukunftsForen') (BMBF, 2016a). The forums combine multiple instruments and approaches, starting with a representative survey, moderated workshops as well as direct discussion with the Minister for Education and Research. Another platform, the citizen science forum "Citizens create knowledge" ('Bürger schaffen Wissen') is designed to facilitate inspiration, networking and discussion for citizens interested and actively involved in science. Besides, Federal Government, private foundations, science organizations and private business have initiated the non-profit "house of the future" ('Haus der Zukunft') in July 2014 which is planned to open in 2017.

Platforms and networks for connecting various R&I actors are largely topical in Germany. A notable example is the "Platform Industry 4.0" ('Plattform Industrie 4.0') supported by both BMBF and BMW where representatives from business, science, associations, trade unions and federal ministries discuss a broad range of issues (e.g. standards or legal frameworks) arising from increasingly digital and interconnected manufacturing.

Finally, several social innovation initiatives have been triggered by the need for integration of refugees in Germany.

## **5. Innovation challenges**

### **5.1 Challenge 1 Reinvigorate innovation in SMEs**

#### **Description**

SMEs represent the vast majority of enterprises and their R&D investments assure that innovation in Germany is broadly shared and applied. While SME R&D intensity remained constant between 2006 and 2014, innovation expenditure has been comparably low and innovation intensity decreasing. According to an analysis of the EFI Commission (EFI, 2016) this trend can be attributed to several factors: a) changes in group of SMEs between 2006 – 2013 (many innovation intensive SMEs outgrew the classification while newly founded firms entering the group of SMEs have been considerably less innovation intensive); b) innovation expenditure per young SMEs fell significantly between 2006 –

2013 (while R&D expenditure remained stable); c) the number of young SMEs declined, linked to a decline in start-up activity since 2004 (also see chapter 5.3 Encourage Entrepreneurship).

In contrast, large companies with more than 500 employees have expanded their innovation expenditures much more dynamically. In 2015, their average share of innovation expenditures on sales (innovation intensity) is 5.1% compared with 4.7% in 2006, while SMEs moved from 1.8% in 2006 to 1.6% 2015 (ZEW, 2017). In addition, SMEs engaging in R&D only occasionally, e.g. for particular projects, have reduced their innovation expenditures significantly. The innovation expenditures of SMEs (5 to 249 employees) with occasional R&D are more than 40% lower in 2013 than in 2006, albeit their share in the overall volume of innovation expenditures is comparatively low (EFI, 2016).

On the output side SME patent intensity is located in the middle range, product and process innovations are very high but declining (between 2008 – 2012) and the same trend can be observed for turnover generated with product innovation which is high but was declining as well between 2008 – 2012 (EFI, 2016). The European Innovation Scoreboard 2016 confirms this trend for SME innovation indicators with fewer SMEs creating product or process innovations (-3.1%) as well as marketing or organisational innovations (-5.4%) compared to the previous year.

SMEs in Germany report that the most important barriers to innovation between 2012 and 2014 were high innovation costs, high economic risks, a lack of qualified personnel and a lack of internal funds (EFI, 2016).

R&D tax credits are currently absent from the portfolio of instruments for encouraging R&I in Germany.

### **Policy response**

There is an established system of support for innovation in SMEs in place. Some of the major schemes include ZIM, KMU innovative, ERP innovation programme, INVEST and EXIST to name only some<sup>5</sup>. In the beginning of 2016, BMBF launched its new initiative "Priority to SMEs" announcing increases of 30% in funding available to SMEs, reaching €320m in 2017. In its 2016 report the EFI Commission also notes that Federal and EU funding has been expanding while Länder funding declined (EFI, 2016).

### **Policy Assessment**

Public resources and policy attention are focussed on the issue. It remains open whether current policies reach small SMEs and those with occasional R&D needs, i.e. the major contributors to the declining trend. The EFI Commission recommends R&D tax credits in its report for 2016, a measure that would keep bureaucratic efforts for SMEs low (EFI, 2016). However, the evidence for impact of R&D tax incentives is very inconclusive. For some barriers named by SME (as cited above), tax incentives are unlikely to provide a solution. The German government has so far not reacted on the calls of EFI (and industry) for the introduction of tax credits

Most of the obstacles to innovation for SMEs stem from shortages of financial and human resources. According to the EFI Commission some these problems could be alleviated by supporting more innovative entrepreneurship, by further strengthening venture capital markets, increasing the supply of skilled R&I personnel as well as reducing the administrative burdens for hiring from abroad or integrating immigrant employees. The report also recommends an overhaul of the funding programmes at federal and Länder level to reduce complexity and check for potential duplication (EFI, 2016).

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<sup>5</sup> These initiatives have been described in detail in Sofka W., Sprutacz M. (2016); RIO Country Report 2015: Germany

## **5.2 Challenge 2 Capitalise on business opportunities from the digital economy**

### **Description**

Expectations are high for the digitisation of production processes to deliver strong productivity growth, particularly in manufacturing, through innovations in ICT. There is concern that many companies, especially SMEs, are underestimating the importance of digital change. On the positive side, a large number of start-ups are coming up with innovative digital business models in all sectors but public support seems to be skewed towards industry targeted schemes, neglecting important growth areas such as healthcare, financial services, commerce and construction (EFI, 2016). Then again, within a business model framework the creation and capture of economic value is central, not necessarily the control or creation of technologies per se. German public (E-)administration that could be leading as a good example is somewhat lagging behind. The Digital Economy and Society Index (DESI) of the European Commission ranks Germany 18th of EU Member States in Digital Public Services in its 2016 report and significantly below its overall digital performance (9th rank) (European Commission, 2016a).

### **Policy response**

Over the past years, some important steps have been taken as acknowledged by the EFI Commission (EFI, 2016). These include notably the restructuring of the Platform Industry 4.0 through contributions from multiple ministries and the creation of the German Internet Institute ('Deutsches Internet-Institut'). BMBF also increased support for Electronic health research and BMWi managed a process by which half the measures outlined in the Digital Agenda 2014-2017 have been addressed systematically. The creation of an Industrial Data Space which is particularly designed for the demands of SMEs is another positive sign. The above mentioned programme "Priority to SMEs" supports digitization of SMEs. A new central policy document, the Digital Strategy 2025, was presented in March 2016, outlining measures für e.g. the development of infrastructures and intelligent networks.

### **Policy Assessment**

There are many but also fragmented support schemes that lack coordination between ministries. Increased coordination, priority setting and resource allocation can unlock potential in the follow up of the Digital Agenda 2014-2017. Progress towards E-Government is slow. Improvements in this field would also have the potential to stimulate government induced demand (see section 4 on creating and stimulating markets).

While the Expert Commission on Research and Innovation underlines the business sector's responsibility to not "rest on the laurels of past export and innovation successes in the face of an emerging wave of disruptive innovation" it still sees an important contribution to be made by public policy (EFI, 2016). The report advocates actively encouraging the business model innovation in the digital economy but also facilitating adaption processes in sectors which are disrupted by digital business innovation.

## **5.3 Challenge 3 Encourage entrepreneurship**

### **Description**

Both innovation challenges discussed above are connected to shortcomings in entrepreneurship performance in Germany.

Only 7.3% of firms in Germany were newly founded in 2013, down from 8.6% in 2010. Other innovation leader Member States such as Denmark (10.3%) or the Netherlands (10.5%) have significantly higher firm birth rates. Entrepreneurship reached an especially low level in Germany in 2015 with 763,000 start-ups, 17% less than 2014 (KfW Research, 2016a). This low level can be partially explained with the strong labour

market in Germany in 2015 which reduced the need for necessity-entrepreneurship from individuals without alternative job opportunities. Then again, survival rates of newly founded firms in Germany are also comparatively low. 52.7% of newly founded firms in 2010 in Germany were still in existence in 2013, compared with 68.9% in the Netherlands.

The challenge originates from a mix of problems including underdeveloped small venture capital markets, tax and regulatory obstacles, a lack of exit prospects for venture capital providers as well as demographics and promising existing career opportunities in established companies thanks to a healthy labour market.

### **Policy response**

Focusing on the lack of financing for young firms, the comparatively small market for venture capital in Germany is a persistent challenge. The Federal Government has approved a cornerstone paper of the Federal Ministry of Finance ('Bundesministerium der Finanzen,' BMF) for support for venture capital in Germany ('Eckpunktepapier zur Förderung von Wagniskapital in Deutschland') in September of 2015. Accordingly, some issues raised by EFI (2015) are addressed: In particular, the creation of the ERP/EIF growth fund ('ERP/EIF-Wachstumsfonds') with a volume of €500m, the extension of the ERP/EIF-Venture Capital Fund of Funds ('ERP/EIF-Venture-Capital-Dachfonds') to €1.7b, as well as making KfW a more visible anchor investor. There have also been changes to the implementation of INVEST – Zuschuss Wagniskapital (increased maximum investment per investor of €500,000 and making INVEST subsidy tax exempt) following a recent evaluation of the programme which was generally favourable (ZEW, 2016). Besides, the policy paper expresses support for other recommendations of EFI (2015), such as favourable tax treatment for fund management costs or carried interest, but does not go beyond that.

### **Policy Assessment**

Policy makers have demonstrated sensitivity to recent evaluation reports and improved procedures as well as framework conditions (EFI, 2015; ZEW, 2016) which led to an improvement of the German venture capital landscape. The EFI Commission further notes in its 2016 report that crowding out of private capital by public capital does not seem to occur. Capitalising on the complementarity between private and state supported VC projects and exploration of co-funding seems to present itself as the most appropriate approach (EFI, 2016). On the other hand, the absence of a stock market segment for Initial Public Offerings (IPOs) for venture capital remains a crucial disadvantage. Further potential also lies in attracting more foreign entrepreneurs and fully exploiting labour market potential of women and people with a migrant background including refugees.

## **6. Focus on creating and stimulating markets**

*This section aims at describing and assessing national level efforts to introduce demand-side innovation policies to stimulate the uptake of innovation or act on their diffusion, including public procurement and regulations supporting innovation. It also analyses policy measures aimed at internationalisation of companies with the aim of increasing the innovativeness of the economy.*

Tools at the disposal of public authorities for stimulating markets include demand driven innovation, the creation of innovation friendly legislative framework, standard setting and fostering the internationalisation of companies.

The concept of innovation-oriented public procurement has been included as a goal in several of the most important strategic documents of innovation policy at federal level, such as the Digital Agenda 2014 – 2017. However, binding strategies or concrete national targets across all public bodies for PCP or PPI do not exist. The latest change to the legal public procurement framework in Germany occurred in April 2016 when the law for the modernisation of public procurement ('Gesetz zur Modernisierung des



Vergaberechts, Vergaberechtsmodernisierungsgesetz - Vergmodg') went into effect (Deutscher Bundestag, 2016a). According to BMWi, the implementation of the new EU public procurement directives should make procedures in Germany more flexible and user-friendly while increasing legal certainty for companies and public procurers.

The Competence Centre for Innovative Public Procurement KOINNO advising procurers at all levels of public administration has been externally evaluated in March 2016 (Technopolis, 2016). According to the report the centre is overall performing well and is reaching significant audiences. The report nevertheless recommends improving communication strategies, introduction of certification process to increase visibility of successful innovative procurement as well as structural adjustments, i.e. the creation of a one-stop-shop solution for innovative and sustainable procurement.

In 2015 and 2016, several legislative changes to ease administrative burden on companies were introduced such as the law for the reduction of bureaucratic burden ('Bürokratieentlastungsgesetz') and a work programme for improved legislation processes ('Arbeitsprogramm Bessere Rechtsetzung 2016'). Other important changes to the regulatory environment for innovation include the reform of law for telecommunications and media ('Telemediengesetzes') (Deutscher Bundestag, 2016b) which took effect in July 2016. The law clarifies, among other things, the liability of internet access providers for illegal content. The absence of clear liability rules was seen as detrimental to experimentation with new business models. Focusing on standard setting, the Federal Government has laid out a political concept for the role of norms ('Normungspolitisches Konzept der Bundesregierung'). The support and dissemination of innovation and research outcomes is an explicit goal of this concept (Deutsche Bundesregierung, 2009). BMWi had initiated a research programme with the German Institute for Standardization ('Deutsches Institut für Normung,' DIN) in 2006 on Innovation with Norms and Standards ('Innovation mit Normen und Standards,' INS) which delivered its final report in 2015. The final report provides a host of projects by which norms and standardization have advanced innovation in Germany (DIN, 2015).

Internationalisation is a particularly salient topic for German politics given the importance of international markets for the economy. BMWi provides comprehensive support for firm internationalisation with the website ixpos as a central online platform. Support measures directed at SMEs have been centralised in the BMWi programme "Measures for foreign market entry for small and medium sized firms in manufacturing and services" ('Maßnahmen zur Erschließung von Auslandsmärkten für kleine und mittlere Unternehmen des produzierenden Gewerbes und für Dienstleister') since 2012. Dedicated export initiatives exist for renewable energy ('Exportinitiative Erneuerbare Energien'), energy efficiency ('Exportinitiative Energieeffizienz'), healthcare ('Exportinitiative Gesundheitswirtschaft') as well as security technologies and services ('Exportinitiative Sicherheitstechnologien und -dienstleistungen'). Support for internationalization occurs also in the form of government support for export financing and risk management. KfW IPEX-Bank is a dedicated bank for export financing and part of the government owned bank KfW.

According to BMWi, the implementation of the new EU public procurement directives should make procedures in Germany more flexible and user-friendly while increasing legal certainty for companies and public procurers. According to the Technopolis evaluation of KOINNO, the centre is overall performing well and is reaching significant audiences. The report nevertheless recommends improving communication strategies, introduction of certification process to increase visibility of successful innovative procurement as well as structural adjustments, i.e. the creation of a one-stop-shop solution for innovative and sustainable procurement.

The absence of clear liability rules for internet providers was seen as detrimental to experimentation with new business models. It is still too early to assess the effects of the reform of the law for telecommunications and media.

Support for firm internationalisation is well developed.

## References

- Aksoy, Y., H.S. Basso, T. Grasl und R.P. Smith (2015), Demographic structure and macroeconomic trends, Economics and Finance Working Paper 1501, Birkbeck, University of London.
- Bersch J., Gottschalk S., Mueller B. & Wagner S. (2016), Unternehmensdynamik in der Wissenswirtschaft in Deutschland 2014, [http://www.e-fi.de/fileadmin/Innovationsstudien\\_2016/StuDIS\\_03\\_2016.pdf](http://www.e-fi.de/fileadmin/Innovationsstudien_2016/StuDIS_03_2016.pdf).
- BMBF (2014), Die Neue Hightech-Strategie - Innovationen für Deutschland [http://www.bmbf.de/pub\\_hts/HTS\\_Broschüre\\_Web.pdf](http://www.bmbf.de/pub_hts/HTS_Broschüre_Web.pdf).
- BMBF (2016a), Bundesbericht Forschung und Innovation 2016, [https://www.bmbf.de/pub/Bufi\\_2016\\_Hauptband.pdf](https://www.bmbf.de/pub/Bufi_2016_Hauptband.pdf).
- BMBF (2016b), Daten und Fakten zum deutschen Forschungs- und Innovationssystem - Bundesbericht Forschung und Innovation 2016 - Ergänzungsband 1, <https://www.bmbf.de/de/bundesbericht-forschung-und-innovation-735.html>.
- BMBF (2016c), Forschungsrahmenprogramm der Bundesregierung zur IT-Sicherheit - Selbstbestimmt und sicher in der digitalen Welt 2015-2020, [https://www.bmbf.de/pub/Forschungsrahmenprogramm\\_IT\\_Sicherheit.pdf](https://www.bmbf.de/pub/Forschungsrahmenprogramm_IT_Sicherheit.pdf).
- BMBF (2016d), Rahmenprogramm der Bundesregierung für Forschung und Innovation 2016 - 2020 - Mikroelektronik aus Deutschland - Innovationstreiber der Digitalisierung, [https://www.bmbf.de/pub/Rahmenprogramm\\_Mikroelektronik.pdf](https://www.bmbf.de/pub/Rahmenprogramm_Mikroelektronik.pdf).
- BMWi (2014), Digital Agenda 2014-2017, <http://www.bmwi.de/English/Redaktion/Pdf/digital-agenda-2014-2017,property=pdf,bereich=bmwi2012,sprache=en,rwb=true.pdf>.
- BMWi (2015), Monitoring-Report Wirtschaft Digital 2015, <http://www.bmwi.de/BMWi/Redaktion/PDF/M-O/monitoring-report-wirtschaft-digital-2015,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf>.
- BMWi (2016), Fakten zum deutschen Außenhandel, <http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/fakten-deutscher-aussenhandel,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf>.
- Council of the European Union (2016), Recommendation for a Council Recommendation on the 2016 national reform programme of Germany and delivering a Council opinion on the 2016 stability programme of Germany
- Deutsche Bundesregierung (2009), Normungspolitische Konzept der Bundesregierung <https://www.bmwi.de/BMWi/Redaktion/PDF/M-O/normungspolitische-konzept-der-bundesregierung,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf> (8/2016).
- Deutscher Bundestag (2016a), Gesetz zur Modernisierung des Vergaberechts (Vergaberechtsmodernisierungsgesetz - Vergrmodg), [http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger\\_BGBl#\\_bgbl\\_%2F%2F\\*%5B%40attr\\_id%3D%27bgbl116s0203.pdf%27%5D\\_1470150946693](http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl#_bgbl_%2F%2F*%5B%40attr_id%3D%27bgbl116s0203.pdf%27%5D_1470150946693) (8/2016).

- Deutscher Bundestag (2016b), Zweites Gesetz zur Änderung des Telemediengesetzes, [http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger\\_BGBL#\\_bgbl\\_%2F%2F\\*%5B%40attr\\_id%3D%27bgbl116s1766.pdf%27%5D\\_1470324725478](http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBL#_bgbl_%2F%2F*%5B%40attr_id%3D%27bgbl116s1766.pdf%27%5D_1470324725478) (8/2016).
- DIN (2015), Innovation mit Normen und Standards - Ergebnisbericht 2015, <http://www.din.de/blob/64124/b7422d3499c8199fad17290ff94ab291/ins-2015-data.pdf> (8/2016).
- EFI – Commission of Experts for Research and Innovation (2015): Report on research, innovation and technological performance in Germany 2015, Berlin: EFI.
- EFI – Commission of Experts for Research and Innovation (2016): Report on research, innovation and technological performance in Germany 2016, Berlin: EFI.
- European Commission (2015), Innovation Union Scoreboard 2015, [http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015\\_en.pdf](http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf).
- European Commission (2016a), Digital Economy and Society Index (Desi) 2016 Country Profile Germany, <https://ec.europa.eu/digital-single-market/en/scoreboard/germany>.
- European Commission (2016b), Commission Staff Working Document - Country Report Germany 2016 Including an In-Depth Review on the prevention and correction of macroeconomic imbalances
- GWK (2016a), Pakt für Forschung und Innovation: Monitoring-Bericht 2016
- GWK (2016b), Verwaltungsvereinbarung zwischen Bund und Ländern gemäß Artikel 91b Absatz 1 des Grundgesetzes zur Förderung des forschungsbasierten Ideen-, Wissens- und Technologietransfers an deutschen Hochschulen Vom 16. Juni 2016 - „Innovative Hochschule“ - <http://www.gwk-bonn.de/fileadmin/Papers/Verwaltungsvereinbarung-innovative-Hochschule-2016.pdf>.
- IEKE (2016), Internationale Expertenkommission zur Evaluation der Exzellenzinitiative - Endbericht, <http://www.gwk-bonn.de/fileadmin/Papers/Imboden-Bericht-2016.pdf>.
- KfW (2014), Gründerinnen holen auf – Selbstständigkeit als Weg in die Erwerbstätigkeit <https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-Fokus-Volkswirtschaft/Fokus-Nr.-71-September-2014.pdf> (8/2016).
- KfW Research (2016a), KfW-Gründungsmonitor 2016, <https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-Gr%C3%BCndungsmonitor/Gr%C3%BCndungsmonitor-2016.pdf>.
- KfW Research (2016b), Migranten überdurchschnittlich gründungsaktiv - Arbeitsmarkt spielt große Rolle <https://www.kfw.de/PDF/Download-Center/Konzernthemen/Research/PDF-Dokumente-Fokus-Volkswirtschaft/Fokus-Nr.-115-Januar-2016-Migrantengr%C3%BCndungen.pdf> (8/2016).
- Nationaler Normenkontrollrat (2015), E-Government in Deutschland: Vom Abstieg zum Aufstieg, [https://www.normenkontrollrat.bund.de/Web/NKR/Content/DE/Pressemitteilung/en/2015\\_11\\_18\\_pm\\_it\\_gipfel\\_u\\_gutachten\\_egov.html?nn=1669656](https://www.normenkontrollrat.bund.de/Web/NKR/Content/DE/Pressemitteilung/en/2015_11_18_pm_it_gipfel_u_gutachten_egov.html?nn=1669656) (8/2016).

- OECD (2016a), Compendium of Productivity Indicators 2016, <http://www.oecd-ilibrary.org/docserver/download/3016011e.pdf?expires=1470490012&id=id&accname=ocid194738&checksum=B58665EF050AA35ED14EB8DA594B626D>.
- OECD (2016b), Digital Government Strategies for Transforming Public Services in the Welfare Areas, <http://www.oecd.org/gov/digital-government/Digital-Government-Strategies-Welfare-Service.pdf>.
- Rammer C., Gottschalk S., Peters B., Bersch J. & Erdsiek D. (2016), Die Rolle von KMU für Forschung und Innovation in Deutschland [http://www.e-fi.de/fileadmin/Innovationsstudien\\_2016/StuDIS\\_10\\_2016.pdf](http://www.e-fi.de/fileadmin/Innovationsstudien_2016/StuDIS_10_2016.pdf).
- Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2015), Jahresgutachten 2015 – 2016, Zukunftsfähigkeit in den Mittelpunkt
- Schasse U., Belitz H., Kladroba A., Stenke G. & Leidmann M. (2016), Forschung und Entwicklung in Staat und Wirtschaft, Studien zum deutschen Innovationssystem, [http://www.e-fi.de/fileadmin/Innovationsstudien\\_2016/StuDIS\\_02\\_2016.pdf](http://www.e-fi.de/fileadmin/Innovationsstudien_2016/StuDIS_02_2016.pdf).
- Sofka W., Sprutacz M. (2016); RIO Country Report 2015: Germany.
- Stifterverband (2015), FuE-facts -April 2015
- Stifterverband (2017); Forschung und Entwicklung in der Wirtschaft 2015.
- Technopolis (2016), Evaluierung des Kompetenzzentrums Innovative Beschaffung, <link: [http://de.koinno-bmw.de/system/publications/files/000/000/363/original/Evaluierung\\_des\\_Kompetenzzentrums.pdf?1464690599](http://de.koinno-bmw.de/system/publications/files/000/000/363/original/Evaluierung_des_Kompetenzzentrums.pdf?1464690599) (8/2016)>.
- World Bank (2016), Doing Business 2017 - Measuring Regulatory Quality and Efficiency, <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB17-Report.pdf>.
- ZEW (2016), Evaluation des Förderprogramms „Invest - Zuschuss für Wagniskapital“, [http://ftp.zew.de/pub/zew-docs/gutachten/Evaluation\\_INVEST\\_20160616.pdf](http://ftp.zew.de/pub/zew-docs/gutachten/Evaluation_INVEST_20160616.pdf) (8/2016).
- ZEW (2017), Innovationsverhalten der deutschen Wirtschaft - Indikatorenbericht zur Innovationserhebung 2016, [http://www.zew.de/fileadmin/FTP/mip/16/mip\\_2016.pdf](http://www.zew.de/fileadmin/FTP/mip/16/mip_2016.pdf) (01/2017)

## List of abbreviations and definitions

AiF	Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" (German Federation of Industrial Research Associations)
BERD	Business enterprise expenditure on R&D
BMBF	Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research)
BMWi	Bundesministerium für Wirtschaft und Technologie (Federal Ministry of Economics and Technology)
CIS	Community Innovation Survey
DFG	Deutsche Forschungsgemeinschaft (German Research Foundation)
DESI	Digital Economy and Society Index
EFI	Expertenkommission Forschung und Innovation (Experts Commission for Research and Innovation)
ERA	European Research Area
ERDF	European Regional Development Fund
FhG	Fraunhofer-Gesellschaft (Fraunhofer Society)
GBAORD	Government Budget Appropriations or Outlays on R&D
GERD	Gross domestic expenditure on R&D
GWK	Gemeinsame Wissenschaftskonferenz (Joint Science Conference)
HGF	Helmholtz-Gemeinschaft Deutscher Forschungszentren (Helmholtz Association)
MPG	Max-Planck-Gesellschaft (Max Planck Society)
R&D	Research and development
RIO	Research and innovation observatory
WGL	Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (Leibniz Association)

## Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016
GDP per capita (euro per capita)	30600	32100	33700	34300	35000	36000	37100	
Value added of services as share of the total value added (% of total)	71.46	69.12	68.61	68.51	68.87	68.69	68.88	
Value added of manufacturing as share of the total value added (%)	19.93	22.19	22.9	22.73	22.5	22.97	22.81	
Employment in manufacturing as share of total employment (%)	17.8	17.4	17.52	17.64	17.58	17.55	17.45	
Employment in services as share of total employment (%)	73.53	73.92	73.78	73.67	73.8	73.86	74.09	
Share of Foreign controlled enterprises in the total nb of enterprises (%)	1.13	1.3	1.28	1.14	1.23			
Labour productivity (Index, 2010=100)	97.6	100	102.1	102.7	103.5	103.9	104.7	106
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	2	2.07	2.24	2.32	2.29	2.28	2.3	
Summary Innovation Index (rank)	5	4	4	4	4	5	5	
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				66.9		67		
Innovation output indicator (Rank, Intra-EU Comparison)			4	3	3	3		
Turnover from innovation as % of total turnover (Eurostat)		15.5		13				
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						15	15	17
Ease of getting credit (WB GII) (Rank)						22	27	
Venture capital investment as % of GDP (seed, start-up and later stage)	0.029	0.029	0.029	0.021	0.023	0.021	0.025	
EC Digital Economy & Society Index (DESI) (Rank)						10	10	9
E-Government Development Index Rank		15				21		15
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	48	50	50	51	49	53	53	55
GERD (as % of GDP)	2.72	2.71	2.8	2.87	2.82	2.89 2.99*	2.87	
GBAORD (as % of GDP)	0.88	0.89	0.88	0.87	0.9	0.87	0.85	
R&D funded by GOV (% of GDP)	0.81	0.82	0.84	0.84	0.82	0.83		
BERD (% of GDP)	1.84	1.82	1.89	1.95	1.9	1.95 2.05*	1.95	
Research excellence composite indicator (Rank)				8				
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		11.4	11.51	11.27	11.52			
Public-private co-publications per million population	54.44	56.98	60.48	56.99	54.99	53.02		
World Share of PCT applications	10.99	10.88	10.45	9.72	8.91	9.22		

\*National source (Stifterverband, 2017)

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